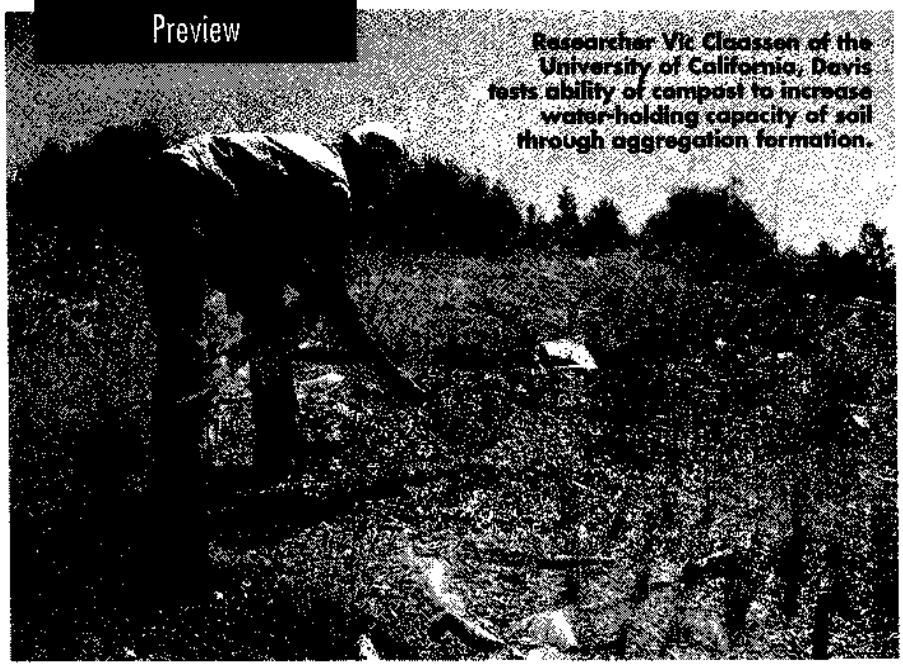

Researcher Vic Claassen of the University of California, Davis tests ability of compost to increase water-holding capacity of soil through aggregation formation.

ROADWAY PLOTS IN SAN JOSE

EFFECT OF COMPOST AND TILLAGE ON ESTABLISHING PLANTS

Researchers from soil centers at the University of California are studying ways to establish native shrubs and grasses in arid climates without use of irrigation systems. One of those scientists is Vic Claassen of the Land, Air and Water Resources Department from the Davis campus, who is studying the effect of compost and tillage on plants in degraded roadside soils.

Funding for the research, done in cooperation with the California Department of Transportation (Caltrans), is provided by the City of San Jose, which provided compost from the BFI Newby Island Organics site.

Claassen is testing the ability of compost to increase water-holding capacity of soil through aggregation formation. Compost contains microorganisms and decomposing organic materials that aid in the formation of soil aggregates. Bacteria and fungi attach themselves to soil particles and bind them together, forming tiny aggregate crumbs. The spaces inside and between these aggregates allow excess water to percolate through the soil and air to reach plant roots. They form caves and voids that are reservoirs of water protected from evaporation. Plant roots penetrate these aggregates and utilize water reserves in times of drought.

The field research project, on Caltrans right-of-way in San Jose, is sited on a southwest facing slope that presents challenges for plant establishment. The coarse fraction (rock content) in the soil is about 70 percent and there's little water. Mean annual rainfall in San Jose is less than 15 inches and occurs primarily between October and April, leaving plants high and dry May through September. Plants at the project site have to contend with 15 hours a day of hot summer sun combined with the heat generated by a sea of asphalt.

Fifteen years ago, Caltrans adopted an Integrated Vegetation Management (IVM) program for its roadsides. A major component of the IVM is the development of structural designs and construction methodologies that reduce the need for ongoing vegetation management.

WATER DELIVERY SYSTEMS

Jack Broadbent, Supervising Landscape Architect in Caltrans Office of Roadside Management, points out that water-delivery systems are a major expense for highway landscaping. "Irrigation systems are expensive to install and must be maintained against normal wear and tear as well as accidental damage," says Broadbent. "If the irrigation system tubing is damaged, you typically find out too late, when the plants start to die."

Water is a precious commodity, and growing more precious every day in the arid west as farmers, fish and a burgeoning population compete for dwindling resources. "In case of an extended drought period, roadside landscaping will likely be the first to feel the pinch," says Broadbent.

To reduce sediment runoff and slope erosion, Caltrans staff use compost on landscaped roadside at less than $40/cubic yard applied.

Karin Grobe

Claassen's research involves evaluating the ability of compost and tillage treatments to increase water availability to the plants. The plants being used are Coyote Bush (*Baccharis pilularis*) and Purple Needlegrass (*Nassella pulchra*). Both plants are native to California.

The plant available water (PAW) in the fine earth fraction of the soil at the San Jose research site is 9.5 percent. When a given volume of this soil is amended with 25 percent compost (volume to volume), the PAW becomes 12.5 percent. "Water resources within the volume of rootable soil are increased," says Claassen, "and the compost addition improves root density, water infiltration, nutrient availability and microbial activity, providing additional benefits for plant growth."

RESEARCH TREATMENTS

There are eight research treatments: 1) Control – no tillage, no compost; 2) Control – no tillage, 6 cm compost applied as

surface mulch; 3) Till to 50 cm, no compost; 4) Till to 50 cm, 6 cm compost applied as surface mulch; 5) Till to 50 cm, incorporate 6 cm compost to a depth of 25 cm (25 percent volume to volume); 6) Till to 50 cm, incorporate 12 cm compost to a depth of 50 cm (25 percent volume to volume); 7) Till to 100 cm, incorporate 6 cm compost to a depth of 25 cm (25 percent volume to volume) and 8) Till to 100 cm, add 20 percent water-retentive clay to lower 50 cm, incorporate 6 cm compost in upper 25 cm (25 percent volume to volume).

Each treatment is 1.5 meters wide with a 50-centimeter buffer between different plots. Treatments are replicated three times in a random arrangement. All plots are covered with weed mat and five cm of chip bark mulch.

Treatments 1 and 2 test the effect of compost applied as surface mulch on untilled plots. If a surface mulch conserves moisture or keeps the soil cooler, the mulched plants should be larger.

Treatments 3 to 6 test a uniform tillage depth to 50 cm, but with differing amounts of compost added. Compost is applied as a surface mulch in treatment 4, whereas it is tilled to depth in treatments 5 and 6. Plant growth of these treatments will be compared to treatment 3 (till but no compost). Treatment 7 evaluates whether deep rooting is limited by the hard-packed gravels at this site. Compost loading is the same amount and depth as for treatment 5. Treatment 8 is an ultimate intensive treatment with deep tillage, a water-retentive clay added at depth, and a similar loading of compost in the top 25 cm.

MONITORING FOR THREE YEARS

The research plots will be monitored over a three-year period. Preliminary results (June 2006) show stunted plants in treatments 1 and 2, with bottom leaves dried out and small leaves at branch tips, indicating some tillage is essential when establishing plants without an irrigation system. Surface mulch has a negligible impact when used alone with no tillage. Plants in treatment 3 fared somewhat better than plants in treatments 1 and 2, but were still generally stunted and dried out. Plants in treatments 4 and 5 were healthy, but smaller in size than those in treatments 6, 7 and 8, which were healthy and had large leaves. The plots with deeper tillage (treatments 7 and 8) may begin to show treatment differences in future seasons as time allows for deep rooting.

"Over time we'll get more information on how intensive a treatment is needed," says Claassen. "Cost-effectiveness and ease of construction of the various treatments will be a key consideration." A cost-effective treatment may involve selecting

"San Jose's contractors compost over 100,000 tons of organics every year," says Michele Young of the city's Environmental Services Department. "Whatever Caltrans does will be followed by local roadway landscaping agencies."

a cheaper treatment but increasing the interplant spacing to allow more available water per plant. Much depends on whether the plant roots will be able to grow beyond the tilled area.

Claassen's project coincides with a period of increased interest and research by Caltrans in compost. Greg Balzer, Senior Landscape Architect, worked with California Integrated Waste Management Board (CIWMB) staff to develop new specifications for reducing sediment runoff and erosion on slopes. (See accompanying article by Brian Larimore, CIWMB and Balzer, in this special report.)

The new specifications provide the tools necessary for designers to increase compost use. Balzer believes they will increase the amount of compost used by Caltrans, which maintains 230,000 acres of landscaped roadside in the state. "Designers had developed specifications that called for compost use before, but only in small quantities," he says. "We went to the designers and found out they were specifying small quantities because compost was costing Caltrans an average of $300 per cubic yard installed." In a typical installation, bagged compost was applied 1/16th inch thick with a hydroseeder. One of the new specifications calls for a two-inch compost blanket applied with a blower truck or slinger-spreader. Other specifications include modified hydroseeding and incorporation of compost prior to planting. Draft specification for compost filter berms and filter socks are under review. "Our goal is to achieve a cost of less than $40/cubic yard applied," says Balzer, who is speaking about the specifications and Caltrans use of compost at the *BioCycle* West Coast Conference (see pages 15-17 of this issue for complete agenda).

While the use of bulk compost results in a lower cost, it also raises the issue of quality control. The new specifications are based on the U.S. Composting Council's Seal of Testing Assurance (STA) standard testing methods. Thresholds are set for compost properties such as pathogens, maturity, stability, soluble salts, contaminants, etc. "We're confident the specs will help ensure high compost quality," says Balzer.

Michele Young of the San Jose Environmental Services Department is pleased that Caltrans is angling toward increased use of compost. "San Jose's contractors compost over 100,000 tons of yard trimmings and other organics every year," she says. "Caltrans represents a huge market for compost and whatever they do will be followed by local roadway landscaping agencies." ■

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